

Impact of Leadership Statistically Speaking

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ABSTRACT

This paper estimates the influence of leadership on company performance. We consider three dimensions of performance - profit, profitability and stock prices and attempt to find empirical evidence of the impact of leadership on each of them using data from the U.S. from 1990 through 2008. The purpose of the paper is wholly devoted to measuring the impact of a quantitative link between company performance and leadership in a model sense, although, admittedly, the leadership style as well as performance is mediated by the form of organizational culture that is present. The intention of the paper is not to explore the differences in the strategic vision of a leader and a non-leader or to compare their differences in the personal qualities, firm and industry context, or examine the effect of these contextual variables on dimensions of vision.

Keywords: *Neo-classical framework, joint probability, maximum likelihood estimate, Akaike information criterion, Schwarz information criterion*

1. INTRODUCTION

To begin with, a bit of intellectual history is in order. While the conceptual apparatus used today is relatively new, the interests of business economists in entrepreneurship, leadership (often named stewardship), and company performance is venerable. It is worth noting that, during the early post-war era, the microeconomic conceptions underlying empirical analyses of the role and impact of company performance and productivity growth seem closer to the older theoretical tradition of microeconomics based on equilibrium process.

In a 1952 review article, Moses Abramowitz stressed the links of then current empirical research to classical thinking and remarked upon the absence of many recent theoretical developments. Yet, despite this absence, the works by Abramowitz (1956) are remarkable in foreshadowing the central conclusion of the studies done somewhat later much within the neoclassical framework – that the growth of output experienced in the United States has been significantly greater than can reasonably be ascribed to input growth. Technological advances, investments in human capital, leadership, reallocations of resources from lower to higher productivity activities of firms, and economies of scale, all were recognized as parts of the explanation. But unfortunately no attempt was made to divide up the credit.

The possibility of significant interaction was recognized by prominent growth theorists from Abramowitz to Simons Kuznets who stressed that company growth is essentially a disequilibrium process that can't be explained within the orthodox framework of neoclassical economics.

Several studies, no table Lieberman and O'Connor (1972)), Han Weiner and Mahoney (1981) found that organizational leaders make little difference in performance. But, many others like Kesner (2002),Boehnke et al(2003), and Athina (2011)do place a premium on effective leadership while trying to evaluate

the performance of companies. As a matter of fact, leadership effectiveness ranks as the second most important criteria analysts use to determine company success, according to a recent (2012) Deloitte Survey¹.

The gap between the value of a company with good leadership and that of a company with weaker leadership is more than 35.5 percent, according to the same 2012 Survey.

Studies which examined the links between leadership and performance coincide with the shift of emphasis away from the 'one best way to lead' to 'context-sensitive' leadership debate. Of particular relevance is the charismatic leadership which Bass and Avolio (1993), Humphreys and Einstein (2003) referred to as transformational leadership. These authors argued that visionary and inspirational skills of transformational leaders motivate followers to deliver superior performance. The following quote by Bass and Avolio (1993) illustrate the critical process and decisions power of the top leaders:

Clearly, directors or CEOs cope with two of the most important problems they face – the limited time they have available and the complexity of the decision making and information with which they must deal (p 110).

Much of the evidence presented as supporting the claim of a leadership-performance link is anecdotal and do frequently over-concentrates on the 'transformational' role of leaders in corporate success. The limited or inconclusive character of research finding suggests the

¹ Deloitte and MIT Sloan Management Review (MIT SMR) began collaborating in 2011 on an annual global research effort to take the pulse of the rapidly evolving world of social business over time. These research results, gathered through surveys and interviews, provide insight into the evolution of social business adoption. The survey report reveals how some organizations are shifting out of first gear on the road to maturity, and offers case study examples of leading-edge social businesses. Deloitte Survey uses the term 'stewardship' for leadership.

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need to empirically verify the nature of the relationship between leadership and performance. This is exactly what the paper intends to do. The purpose of the paper is to provide empirical evidence of the link between leadership and financial performance and thus to assess the relative importance of leadership on our selected performance indicators -profit, profitability and stock prices of companies. Although the literature on leadership, notably West phalet al (2006) suggests that the ability to understand and work within a team or a culture is a prerequisite to leadership effectiveness, we did not explore that link². Neither did we explore the impact of the innate qualities, frequently categorized as 'trait' studies or 'style' of leadership³. Our job is simply to quantitatively establish a link between the leadership (stewardship) variable and company performance in the sense of model building.

2. METHODOLOGY AND VARIABLES

Profits, profitability, and stock prices are taken as dependent variables, each representing a measure of company performance. Leadership, size, corporate technology, GNP, industry sale, competition, retained earnings, and capital structures are taken as independent variables. Of these, GNP, industry sale, and competition are environmental variables and corporate size and corporate technology may be considered as organizational variables. We concentrate on the financial side of corporate performance. This is partly in consideration of the data availability. It is accepted that business performance is a multi-dimensional and highly complex phenomenon. While a number of studies have measured business performance as uni-dimensional or bi-dimensional, following the suggestion by Day and Wensley (1983), we evaluate the company performance on dimensions which reflected a broad balance between customer-focus and competitor-centered perspectives. This measure of leadership and organization performance is synthesized from a range of studies (Table 1 & Table 2) adapted from the various constructs of the previous authors. Hence we define leadership in terms of strategies where strategies are viewed as outcomes or posterior results of decision behavior and do not involve any

²The claim that organizational culture is linked with performance is founded on the perceived role that culture can play in generating competitive advantage (see Krefting and Frost (1985), Prahalad and Bettis (1986)). To this end it is argued that the 'uniqueness' quality of organizational culture makes it a potentially powerful source of generating advantage over competitors. It needs to be remembered here that those who propose the link between the two note that culture remains linked with superior performance only if the culture is able to adapt to changes in company's environmental conditions.

³The major weakness of style or behavioral approaches to leadership is that they ignore the important role which situational factors play in determining the effectiveness of leaders. The general tenet of the situational perspective is that leadership effectiveness is dependent on the leader's diagnosis and understanding of situational factors, followed by the adoption of the appropriate policy or strategy to deal with each circumstance.

speculation as to the intention of those managing the corporation. Rather strategies are defined, as in Saowaalux and Peng (2007), in terms of actual, observable pattern of corporate action or policy.⁴

Ball (1987) and Gordon and DiTomaso (1992) note that procurement of financial resources is a function primarily of top corporate leaders. Capital can be obtained from external source, including debt or selling stocks (equity) or from an internal source reported as retained earnings. So, corporate performance is affected by the organization's ability to acquire financial resources when needed and at a reasonable cost. Therefore, two financial strategies, capital structure and retained earnings are used in this study to represent decision-making variables for the top corporate leaders⁵. In terms of performance profits and profitability (profit relative to asset) are expected to be negatively related to capital structure strategy. Increasing debt creates a fixed financial obligation in the form of interest payments. Increasing debt decreases profit and in addition, debt often is obtained for purposes of expansion thus increasing the organization's assets. Retained earnings, as suggested by Anthony (1987) and others provide autonomy for corporate management from dependence on external capital and equity markets. This earnings strategy is expected to relate positively to profits and assets, though the relationship with profits is, as Nerlove (1968) had shown long time ago, are expected to be stronger.

Stock prices again are expected to be positively associated with retained earnings strategy⁶. Stock prices are also deemed as a function of investor's perceptions of

⁴While more refined definitions of strategic thinking are still emerging, the main focus usually remains on the goals or outcomes of the organization. Even in the systems approach, strategic thinking is compared to a disciplined approach to thinking about the outcomes of an organization and the relationships inherent amongst the many parts of the organizations, See Judge and Piccolo (2004),

⁵Microsoft has retained \$18.9 billion in earning over the years. It has over 2.5 times that amount in stockholder equity (\$47.29 billion), and earned over 12.57% on its equity last year. Obviously, the company is using the shareholder's money very effectively. With a market cap of \$314 billion, the software giant has done an amazing job and credit is given to Microsoft leadership (*The Wall Street*, May 13, 2012).

⁶Shareholders do benefit from the leader's decision to retain earnings. Whenever a company decides to retain earnings, the market rating mechanism evaluates this decision. If the market believes that the retained earnings are efficiently invested, then it places a premium on them and the market value to retained earnings ratio, CMV/RE ratio will be greater than 100%. On the other hand, if the market believes that the retained earnings are inefficiently invested then it will discount their value. The CMV/ RE ratio is less than 100% and the shareholders will be penalized by the company's decision to retain earnings.

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the health of the industry. Therefore a positive association between stock prices and industry is expected, too.^{7,8}

The definition of leadership presumes that a leader's influence begins on assumption of office and ends when she /hear terminated. This is a bit unrealistic. A leader's influence requires some time to permeate the system before it affects organizational outcomes. Lagging the leadership measure is a means of assessing the long term rather than the immediate impact of the individual holding the top position. In keeping with the trend of views of the company CEOs, we take one year lag as the time within which the leadership takes effect. So leadership is defined by specific year to company combinations. For example, leader one is the chief executive officer of the first company who served for two years; leader two is the CEO of the first company for the 3rd through 7th year of the study. Sales is an industry variable incorporated into the model to reflect specific environmental influences on company performance. Shared industry characteristics (e.g., technology, competition) filter the impact of general economic conditions so that firms within the same industry face a similar environment. Because they reflect more specific environmental conditions, industry factors are expected to have a more direct impact than GNP on all dimensions of corporate performance. Industry sales indicate the level of economic activity within an industry and measure a specific aspect of the environment. Industry sales reflect the level of prosperity within an industry and therefore, they should be highly related to corporate profit in the industry.

As to GNP all three dimensions of corporate performance are expected to vary directly with it. What about corporate size? Corporate size is expected to be positively associated with corporate performance. Larger firms can take advantage of economies of scale enabling

⁷Given the continuing interest and empirical attention to corporate governance structures and their relationships to financial performance, we also note there is a stream of research that has found no relationship between corporate governance structures and their relationships to financial performance. John Biggs, CEO and chairman of TIAA-CREF, has strongly defended his institution's focus on governance reform, including reapportionment of the board of directors and separation of the positions of CEO and board chairperson, as a means of improving the performance of firms in his institution's portfolio, as in Zajack *et al* (1995). Notably, practicing managers rarely adopt the view that the separate way is the best way to bring about a superior structure. While it is true that major corporations split the CEO and board chairperson roles (e.g., American Express, Kmart, TWA, Westinghouse) insisted on having both the CEO and board chairpersons titles prior to accepting their positions.

⁸These managers' views are consistent with stewardship theory. Advocates of this theory suggest that the joint structure provides an unified firm leadership and removes any internal or external ambiguity regarding who is responsible for firm process and outcomes. See Donaldson (1990).

more efficient production and thereby increasing the ratio of profits to assets (profitability). Empirically, the interest of economists in productivity differences among firms has mostly been focused on international differences and also, most of the empirical researches are concerned with data at the industry level. While the firm- by- firm comparisons generally show that differences in internal organization, competition, and product demand, an explanation can be made on the international

Table 1: Three Performance Dimensions and Variables in the Model

Influences	Environmental		
	GNP	Industry Sales	Industry Competition
Performance Dimensions			
Profit	+	+	+
Profitability	+	+	+
Stock Prices	+	+	+

are all important, size still remains an important factor. Neoclassical theory explains productivity difference (difference in performance) , especially on the front by differences in factor intensities associated with dissimilar factor prices or by 'capital vintage' defects. Intra-national differences are largely explained in terms of vintages, although in recent years local variations in leadership performance and industry size do play a big role⁹.

Virtually all scholars of company performance now agree on the central role of technological advance. The internal organization or the R & D activity is systematically related to its average technological lead, or lag, compared with the pack. But, the neoclassical model oversimplifies the connections between an industry's & D spending and technological advance and its implicit views of the links between market conditions and profit opportunities for R & D spending. It thus contains an internal contradiction. The model also oversimplifies the way new technology is spread throughout an economic sector.¹⁰ Inter-sector and inter-industry differences, which are considerable, are repressed. In any model that attempts to correlate & D to technology or to predict how R & D allocation may shift as a result of change in market conditions (sale) one must remember that the major

⁹Pratten (1976) in a study of productivity differences among British and Swedish plants came up with a similar opinion. This study showed systematic country differences. Swedish plants had higher output per worker in virtually every industry where a paired plant comparison was made. The reasons put forth by Pratten include greater mechanization in Sweden, better labor relations, and technically more sophisticated management and leadership styles.

¹⁰There are a large number of studies showing that R & D funding and also, patenting, are very sensitive to economic variables that actually influence the profitability of R&D.

element here is uncertainty. But doesn't uncertainty also mean that there will be winners and losers in the technology game or in the R & D game.¹¹ As Donaldson (1980) puts it.

Even where R & D is an important source of technological progress, there appears often to be a strong interaction between learning through experience and through R & D. Learning curves, reflecting reductions in unit production cost as experience accumulates, are steep in the production of aircraft and semi-conductors. This partly explains growing practical experience that leads to smoother, better coordinated action on the part of labor, better management understanding and decision making on the part of leaders, more effective work design and job layout. (p. 350)

We are, however, using technology with a broader brush to encompass all links and elements leading to its adoption that is consistent with the process of technological change. A sample of 25 manufacturing corporations covering an 18- year period

Table 2: Three Performance Dimensions and Variables in the Model

Leadership		Organizational		
Capital Structure Strategy	Retained Earnings Strategy	Stewardship Size	Corporate	Corporate Technology
-	+	+	+	+
-	+	+	+	+
-	+++0			

from 1990 through 2008 was randomly selected from the 1990 Compustat Industrial File. Compustat data files are produced by Standard & Poor's Institutional Market Services, a division of McGraw-Hill, Inc. While Compustat data are ultimately derived from corporate reports, the data are often modified into standard categories. We have a total of 450 observations.¹²

The models, Model 1 and Model 2 (with stewardship as a separate variable) - are estimated by

¹¹The diversity in decision-making is socially valuable. The batting average of scientists, engineers, economists, government officials, leaders, managers, and businessmen in predicting the most important future technological development has been abysmal. Experts very often are wrong both in what they predict will happen and in what they predict won't happen. It is fortunate that there are many different experts who lay their bets in different ways. But diversity also means that there will be winners and losers in the technology game.

¹²Although corporate size was one of the independent variables included in the model, it should be kept in mind that the range within which size could vary was restricted by the source from which data were drawn.

using the maximum likelihood estimate. Maximum likelihood, also called the maximum likelihood method, is the procedure of finding the value of one or more parameters for a given statistic which makes the known likelihood distribution a maximum. We take a fixed random sample {of independent observations}. The question is this sample might have been generated by many different normal population, each having its own parameters, μ and σ_x^2 . Which of these possible alternative populations is most probable to have given rise to the sample values of (X_1, \dots, X_n) ? To answer the question we must estimate the joint probability of obtaining all the n values for each possible normal population (that is, for each set of μ and σ_x^2), and then choose the population whose parameters (μ and σ_x^2) maximize the joint probability of the observed sample values. Our likelihood function $L(X_1, \dots, X_n, \phi_1, \dots, \phi_k)$, where ϕ_1, \dots, ϕ_k denote the parameters of the function which we want to estimate. In the case of a normal distribution of X, the likelihood function in its general form is

$$L(X_1, \dots, X_n; \mu \text{ and } \sigma_x^2) \quad (1)$$

Thus if we draw a random sample of n observations (n = 450 in our study) from the population of a variable

$X \sim (\mu, \sigma_x^2)$ the likelihood function is:

$$\left[\begin{array}{l} \text{joint probability} \\ \text{of observing the} \\ \text{particular sample} \\ X_1, \dots, X_n \end{array} \right] = P(X_1, \dots, X_n) = L(X_1, \dots, X_n; \mu, \sigma_x^2) \quad (2)$$

The maximum likelihood method consists of maximizing the likelihood function (2). If we assume that $Y \sim N(\mu, \sigma^2)$, the joint probability of the n sample values is given by the likelihood function

$$L = f(X_1, \dots, X_n; \mu, \sigma_x^2) = \prod_{i=1}^n \frac{1}{\sqrt{2\pi\sigma_x^2}} \exp \left\{ -\frac{1}{2} \left(\frac{X_i - \mu}{\sigma_x} \right)^2 \right\} \quad (3)$$

where $\prod_{i=1}^n$ denotes the product of n terms.¹³

¹³For a normal distribution,

$$f(x_1, \dots, x_n | \mu, \sigma) = \prod \frac{1}{\sigma \sqrt{2\pi}} e^{-\frac{(x_i - \mu)^2}{2\sigma^2}}$$

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Theorem 1:

The values of the β parameters that maximize the log likelihood function are the same as the values that maximize the likelihood function.

Proof:

This is true because the log function is a strictly increasing function. For any two values of the β parameters, the one that gives a higher value of $L(\beta)$ also gives a higher value of $\log L(\beta)$.

Theorem 2:

Under the assumption that the model is correctly specified, the maximum likelihood estimates of the model parameters are consistent and approximately normally distributed. As the sample grows large, they are efficient.

For proof see any standard text in econometrics, including some recent works, namely Rupert (2010), Lecam and Grace (2000), Das (2006)

3. MODELS ESTIMATED

3.1 Model 1

Variables Defined

Independent: Y = GNP, S = Corporate Sale, C = Competition, Z= Corporate Size, T = Technology, R = Retained earnings, CS= Capital structure, STW = Stewardship
Dependent: Profit, Profitability, Stock Prices

(all variables are expressed in natural log)

$$\ln f = -\frac{1}{2} n \ln (2 \pi) - n \ln \sigma - \frac{\sum(x_i - \mu)^2}{2 \sigma^2}$$

$$\frac{\partial(\ln f)}{\partial \mu} = \frac{\sum(x_i - \mu)}{\sigma^2} = 0,$$

giving

$$\hat{\mu} = \frac{\sum x_i}{n}$$

$$\frac{\partial(\ln f)}{\partial \sigma} = -\frac{n}{\sigma} + \frac{\sum(x_i - \mu)^2}{\sigma^3} = 0$$

$$\hat{\sigma} = \sqrt{\frac{\sum(x_i - \hat{\mu})^2}{n}}$$

Note that in this case, the maximum likelihood standard deviation is the sample standard deviation, which is a biased estimator for the population standard deviation

Log Profit =

$$\beta_0 + \beta_1 \log(Y) + \beta_2 \log(S) + \beta_3 \log(C) + \beta_4 \log(Z) + \beta_5 \log(T) + \beta_6 \log(R) + \beta_7 \log(CS) \tag{4}$$

Log Profitability =

$$\delta_0 + \delta_1 \log(Y) + \delta_2 \log(S) + \delta_3 \log(C) + \delta_4 \log(Z) + \delta_5 \log(T) + \delta_6 \log(R) + \delta_7 \log(CS) \tag{5}$$

Log Stock Prices =

$$\lambda_0 + \lambda_1 \log(Y) + \lambda_2 \log(S) + \lambda_3 \log(C) + \lambda_4 \log(Z) + \lambda_5 \log(T) + \lambda_6 \log(R) + \lambda_7 \log(CS) \tag{6}$$

3.2 Model 2

The same model is estimated by adding stewardship variable with the two period lags in each of the equation:

$$\text{Log Profit} = \beta_0 + \beta_1 \log(Y) + \beta_2 \log(S) + \beta_3 \log(C) + \beta_4 \log(Z) + \beta_5 \log(T) + \beta_6 \log(R) + \beta_7 \log(CS) + \beta_8 \log(STW) + \beta_9 \log(STW)_{+1} \tag{4A}$$

Log Profitability =

$$\delta_0 + \delta_1 \log(Y) + \delta_2 \log(S) + \delta_3 \log(C) + \delta_4 \log(Z) + \delta_5 \log(T) + \delta_6 \log(R) + \delta_7 \log(CS) + \delta_8 \log(STW) + \lambda_9 \log(STW)_{+1} \tag{5A}$$

Log Stock Prices =

$$\lambda_0 + \lambda_1 \log(Y) + \lambda_2 \log(S) + \lambda_3 \log(C) + \lambda_4 \log(Z) + \lambda_5 \log(T) + \lambda_7 \log(R) + \lambda_8 \log(CS) + \lambda_8 \log(STW) + \lambda_9 \log(STW)_{+1}$$

3.3 Results of The Estimation

The analysis of the links between company performance and leadership (stewardship) finds a direct and positive association (Table 2). Indeed the coefficient of multiple determination, s for the Model 2 that includes stewardship, especially the one with a lag, obtains a better fit between the predictive variables and company performance. The relationship between company performance and GNP (Y), technology (T), retained earnings (R), and capital structure (CS) have substantial impact on each dimension of the performance (Table 2). The magnitude and statistical significance of the stewardship variable (STW) is indicative of the company performance being linked with stewardship. A positive

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association between stock prices and company sale is observed in both models as expected. Industry sales reflect the level of prosperity within an industry. Although corporate size (Z) is taken as an independent variable included in the model, and although it is expected to have a positive impact on each accepted dimension of the company performance, it should be kept in mind that the range within which size could vary was restricted by the source from which the sample of the corporations was drawn. The ‘short’ regression has a lower R^2 (Table 3) than the ‘long’ regression (that is, the regression that incorporates stewardship plus stewardship₊₁ variables, Table 4), as one would expect. Notice that Akaike and Schwarz statistics¹⁴ are both lower, as we expected, for the long regression compared to the short regression showing how they penalize for introducing more regressors in the model. But, the values of both statistics are so close that one is hard put to choose the long over the short regression.¹⁵ With respect to $\hat{\sigma}^2$, remember the likelihood function is just a transformation.¹⁶ of $\hat{\sigma}^2$.

.0552 (.076)	-.4531 (.333)	.0413 (5.77)
-.888 (.000)	-.843 (.087)	-.921 (.002)
.734 (.000)	.432 (.000)	1.342 (.006)
2.128. (.713)	3.111 (.154)	2.343 (.113)
- 0.421 (.001)	-0.512 (.004)	4.321 (.007)
$R^2 = .612$	$R^2 = .643$	
	$R^2 = .632$	
Log Likelihood Likelihood -152.96	Log likelihood -221.34	Log -313.19
AIC5.812	AIC 6.234	AIC8.451
Schwarz 5.922 4.4477	Schwarz3.567	Schwarz

Table 3: Estimation of Model 1

Profit	Profitability	Stock Prices
$\beta_i (i = 0 \dots)$	$\delta_i (i = 0)$	$\lambda_i (i = 0)$
1.061 (1.12)	2.453 (1.51)	3.131 (1.45)
.0031 (.144)	.0072 (.156)	2.511 (.002)
-2.451 (.009)	-0.731 (.771)	2.313 (.311)

The standard errors of the regression coefficients are placed in parenthesis.

Lagging stewardship by one year does show an impact on the amount of performance variance explained (Table 6). Overall, a one year lag increases the variance associated with stewardship substantially. Remember some performance measures, namely stock prices, are likely to be more susceptible to long versus short run stage. Although stock prices can show sudden movement, stock prices probably reflect a firm’s reputation built over the long run and so it appears that top leadership should have a long run impact. Profits are expected to be negatively associated with capital structure strategy because increasing debt creates a fixed financial obligation in the form of interest payments. Therefore profitability is seen as negatively related to capital structure. Retained earnings, as expected, relates positively to profits for the reason that they provide autonomy for corporate leaders from dependence on external capital and equity markets. Competition is negatively associated with profitability. One might expect it to be so to the extent that

¹⁴ $AIC = \hat{\sigma}^2 / e^{2k/n}$; Schwartz (also called the Bayesian Information criterion) = $\hat{\sigma}^2 n^{k/n}$

¹⁵The Akaike information criterion (AIC) is usually a measure of the relative quality of a statistical model, for a given set of data. AIC deals with the trade-off between the complexity of the model and the goodness of fit of the model. If we denote the AIC values of the candidate models by $AIC_1, AIC_2,$ and if we let AIC_{min} be the minimum of those values. Then $\exp((AIC_{min} - AIC_i)/2)$ can be interpreted as the relative probability that the i th model minimizes the (estimated) information loss. Schwarz criterion like the AIC criterion aims for the same. Minimizing AIC is statistically equivalent to maximizing entropy AIC does not necessarily provide a test of the model in the sense of testing a null hypothesis.

¹⁶ $L = \frac{n}{2} (1 + \log(2\pi)) + \log \hat{\sigma}^2$ The name of the transformation is

such that the maximum of L is the minimum of $\hat{\sigma}^2$. Consequently choosing the model that maximizes L is the same as choosing one that minimizes $\hat{\sigma}^2$ The likelihood function by itself involves no penalty.

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Table 4: Estimation of Model 2

Profit	Profitability	Stock Prices			
			-3.051 (.007)	-7.644 (.001)	9-.131 (.004)
$\beta_i (i=0)$	$\delta_i (i=0)$	$\lambda_i (i=0)$	7.310 (.000)	7.453 (.001)	11.331 (.002)
3.072 (1.02)	7.452 (1.51)	4.131 (1.45)	13.31 (.007)	14.324 (.061)	19.733 (.008)
2.141 (.063)	3.172 (.141)	4.512 (.007)	$R^2 = .942$	$R^2 = .949$	$R^2 = .987$
-4761 (.091)	-2.78 (2.774)	7.313 (2.911)	Log Likelihood 91.143	Log Likelihood 45.776	Log Likelihood 44.781
11.71 (.096)	-8.452 (3.361)	5.046 (3.47)	AIC4.817	AIC6.432	AIC8.477
-9.842 (.000)	-7.743 (.6813)	-6.021 (3.007)	Schwarz .5.104	Schwarz 3.217	Schwarz7.117
11.142 (.030)	7.111 (.010)	11.331 (.009)	The standard errors of the regression coefficients are placed in parenthesis.		
4.707 (.713)	7.115 (.154)	6.141 (.113)	firms are likely to be not responsive to market conditions and more attuned with each other.		

Table 5: Correlation Matrix of Independent and Dependent Variables

	GNP	Y	S	C	Z	T	R	CS	STW	STW ₊₁
S	.71									
C	.03	.07								
Z	.19	.11	.07							
T	.53	.13	-.05	.98						
R	.33	.30	-.34	.31	.58	.23				
CS	.45	.34	.46	.44	.51	.47				
Profit	.33	.04	.04	.23	.63	.04	.17	-.61	.68	.76
Profitability	-.13	-.05	.33	.00	-.23	-.28	.27	-.48	.73	.74
Stock Prices	.32	.32	.07	.41	.31	-.09	.18	-.61	.78	.88

Table 6: Summary of Table 4 & 5

Explained Variance	R^2	Stewardship
Profit (i).793 (ii).923with stewardship	.612 .942	.213
Profitability(i).238 (ii).644 with Stewardship	.643 .949	.873
Stock Prices (i).171 (ii).731	.632	

The importance and statistical significance of technology obtained is broadly consistent with a range of studies which might suggest the influence of technology on company performance, although the question remains: how is the structure of an industry appropriate for that kind of technology? It may be mentioned in this connection that even where the structure of an industry is appropriate for the application of technology or of an appropriate R & D, successful innovation is far from an automatic result.

An important source of innovative activity is a leadership strategy which supports or hinders such activity. The influence of retained earnings and capital

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structure on profitability indicate an influence of leadership and is of significance. An important policy implication of the finding of positive association between performance and retained earnings (also table 5) is that companies should focus more on retained earnings as a predictor of the future stock performance.

4. CONCLUSION AND A FEW REMARKS

The full model (Model 2) that includes stewardship provides a good fit of a company model promising an existence of a link between company performance and leadership. While this study is designed to provide an evidence of statistical link between leadership (stewardship) and company performance, the results of the study do raise additional questions suggesting alternative avenues for research. Leadership is defined here by a specific year-company relationship. But any variance associated with stewardship may not simply reflect variations in profits, profitability and stock prices because this may not be a function of leadership incumbency alone but of some unspecified variables. Again, lagging stewardship has a substantial impact on company performance. But, some performance measures may be more susceptible to long run than short run.

Just as it is difficult to evaluate the performance of the company CEOs over the past decade based on share price performance alone, it may be difficult to evaluate the wisdom of earnings retention using the same standard. Remember Warren Buffet's recent piece of advice in one of his Twitters (Computerized Investing :Third Quarter, April 8, 2013) :the basic meaning of a business principle is that earnings retention must, in the long run, deliver at least \$1 in market value to shareholders for each \$1 that management retains.

This advice has the virtue of simplicity, easy to measure. Anyone can calculate Berkshire's retained earnings for a five year rolling period and then examine whether the retained earnings result in a corresponding rise in market value reflecting the quality of the decision making of the company leaders. Let us end our discussion by a quote from Gordon (1994)

At the heart of discussion and debate regarding company financial performance and leadership is the view that one adopts regarding leadership decisions. . . . Consideration of multiple theories in evaluating the performance the performance advantages of companies may lead to a more complete understanding of the subtleties which characterize the relationship (p 122)

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